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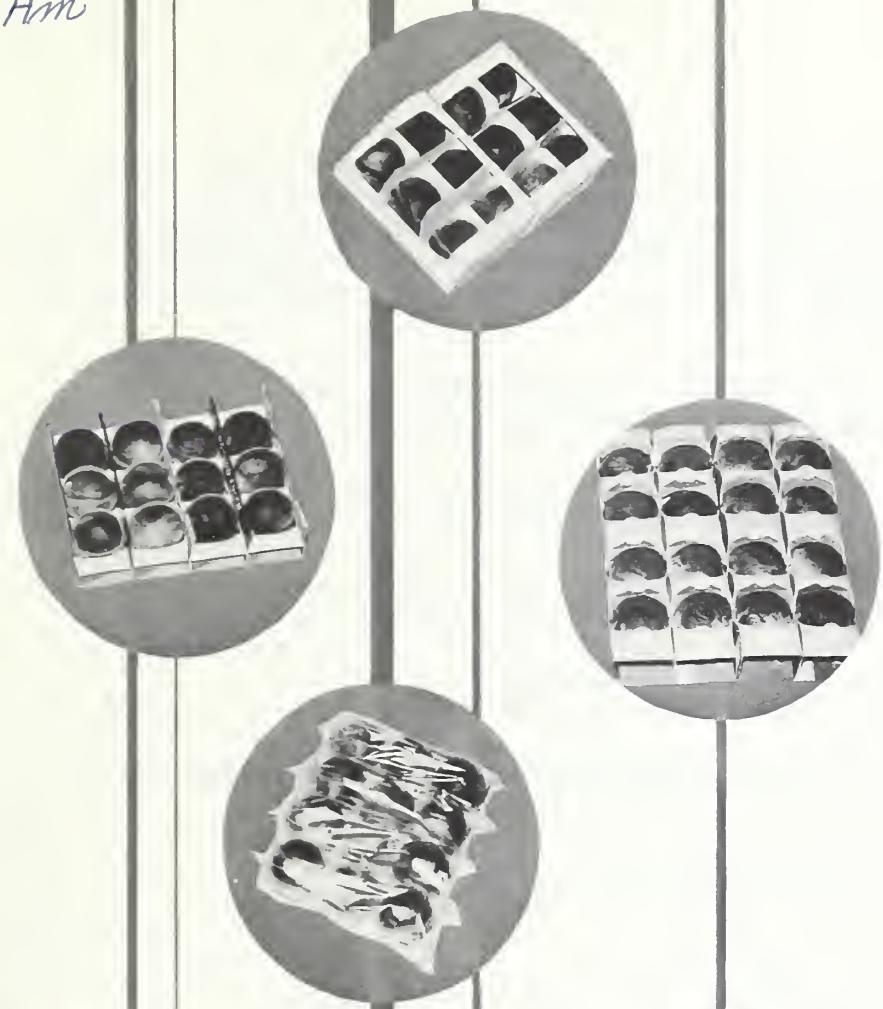

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PREPACKAGING FIRM-RIPE PEACHES

an interim report

AMS-312

UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Marketing Service
Marketing Research Division
Washington, D.C.

PREFACE

This report is one of a number describing new packages and shipping containers and new methods of packing fruits and vegetables in them. The study on which the report is based is part of a broad program of research aimed at improving marketing efficiency and expanding markets for farm products. Related publications previously issued by the U. S. Department of Agriculture include:

Evaluation of Shipping Containers for Western Lettuce,
Marketing Research Report 248, July 1958.

Evaluation of Shipping Containers for Florida Avocados,
Marketing Research Report 228, May 1958.

Packing California Potatoes in Fiberboard Boxes,
Marketing Research Report 214, February 1958.

Development of Carrot Prepackaging,
Marketing Research Report 185, June 1957.

Fresh Fruit and Vegetable Prepackaging, Northeastern Region,
Marketing Research Report 154, February 1957.

New Shipping Containers for Plums,
Marketing Research Report 128, June 1956.

Prepackaging Tomatoes,
Marketing Research Report 20, October 1952.

Prepackaging Apples at Point of Production,
Agriculture Information Bulletin 29, January 1951.

This is a progress report on packaging and shipping riper peaches in 1957 and 1958. Work was conducted in North and South Carolina, West Virginia, Arkansas, Maryland, and Pennsylvania. This report is based primarily on the work in North and South Carolina and Arkansas. The West Virginia, South Carolina, and Arkansas agricultural experiment stations have cooperated in these studies. Further work is planned to reduce bruising in transit and to cut packaging costs.

June 1959

ACKNOWLEDGMENTS

Acknowledgment is made to cooperating warehouses in the New England States, Michigan, and Tennessee, for their assistance in the inspection of test shipments of peaches, and in particular to the following:

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Trexler Orchards, Allentown, Pa.

The study on which the report is based was planned and directed by Donald R. Stokes, in charge of research on prepackaging fresh fruits and vegetables. Philip W. Hale conducted the field work in the initial stages.

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SUMMARY

Research on experimental packages for peaches was undertaken in six States in 1956, 1957, and 1958. The purpose of the research was to find ways to package and market riper peaches. Firm-ripe peaches were prepackaged and shipped to market with companion shipments of less-mature bulk peaches to determine the economic feasibility of prepackaging the riper fruit.

In 1957 the studies were concentrated in seven packinghouses in North and South Carolina, where firm-ripe peaches prepackaged in cartons were compared with less-mature bulk peaches in 3/4-bushel baskets. Sixteen cartons were shipped in a wirebound crate or a combination fiberboard and veneer box.

It cost more to prepackage peaches than to bulk-pack them. However, the prepackaged peaches commanded premium wholesale prices, were bruised less in transit, and were extremely popular with consumers.

The 3/4-bushel basket cost 52 cents compared with approximately $1 for 16 cell-type cartons in either the wirebound crate or the combination fiberboard and veneer box. The average direct labor cost to pack the 3/4-bushel basket was 6 cents compared with about 17 cents to pack 16 cell-type cartons and a master container. Thus, combined materials and direct labor costs for the basket of bulk peaches were 58 cents in contrast to $1.17 for a master container of prepackaged peaches.

Delivered prices received for the prepackaged peaches ranged from $3.75 to $7 per container compared to a range of $2.50 to $6.25 for the 3/4-bushel basket. In 67 of the 68 shipments, the prepackaged peaches brought a higher price. In 1 shipment prices were the same. The average premium paid for the prepackaged peaches was 73 cents, based on 3/4-bushel quantities of peaches.

Fourteen shipments of peaches packed in both consumer cartons and bulk containers were inspected at terminal markets. There was a noticeable difference in bruising among the containers evaluated. The 3/4-bushel basket of bulk peaches had more bruising than the prepackaged peaches. The slightly larger prepackaged peaches in 8-cell cartons showed more bruising than the smaller ones in 10-cell cartons.

There was also a noticeable difference in bruising of peaches marketed by different shippers. The peaches of shippers who maintained strict quality control had less bruising than those of shippers who overlooked the fact that peaches must be of premium quality to receive premium prices.

Condition of the containers evaluated upon arrival at terminal markets was satisfactory. Both bulk and prepackaged containers did the job for which they were designed.

Approximately 34,000 questionnaire cards were inserted in the cell cartons in six of the seven packing plants studied. The cards were color-coded to show dates packed and plant where packed. Of the 34,000 cards, 2,769, approximately 8 percent, were filled out and returned.

On the 2,769 cards returned, 92 percent of the consumers stated that they liked the prepackaged peaches, 88 percent stated that the peaches were in good condition, and 98 percent commented that the containers were not damaged in any way. Forty percent of the returned cards indicated that the peaches were difficult to remove. This difficulty was possibly due to the removal instructions being on the bottom of the carton where they went unnoticed by the consumer.

In general, the comments made it apparent that nearly all the consumers who returned the cards were satisfied and some were delighted with both the quality and the greater maturity of the prepackaged peaches.

Wholesale trade reaction to the prepackaged peaches was good. Receivers commented on the quality and condition of the peaches rather than on the containers. All were impressed by the excellent protection provided by the cell cartons.

Methods of packing were evaluated in the seven plants studied, and several possible improvements were noted. It was estimated that one improvement would cut down the time required to hand-pack the peaches in the cell carton by more than one-third.

In 1958, five types of consumer packages were given preliminary evaluation in Arkansas. They were the 8-cell carton, a plastic tray with polyethylene bag cover, an open folding tray with 6 cells overwrapped with cellophane, an acetate-window carton with folding self-locking cover, and an acetate-window carton with stapled-in recessed bottom.

All of the packages held 6 or 8 peaches and weighed approximately 2 pounds except the plastic tray, which held 3 peaches and weighed about 1 pound. The master containers used were of two types, fiberboard and wire-bound. They held from 12 to 20 packages, depending on type of package. Retailers considered the acetate-window carton with recessed stapled-in bottom the best of the five packages.

In addition to the packages evaluated by the USDA both in Arkansas and on the east coast during the last 3 years, others have been tried out commercially and by other research organizations. Since peach prepackaging has failed to make much progress, apparently no one package is suitable in all respects--cost, ease of packing, protection of peaches, visibility, and retail and consumer acceptance.

More research is needed to reduce the costs of prepackaging peaches and to maintain quality before peach growers will find it economically feasible to market any sizable proportion of their peach crop in consumer packages.

PREPACKAGING FIRM-RIPE PEACHES

An Interim Report

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INTRODUCTION

Prepackaging riper peaches in small packages for sale to consumers is relatively new in the peach industry; however, trends are pointing toward more of it.

Research work aimed at widening market outlets and increasing sales volume for peaches began in 1952.

Studies conducted from 1952 to 1954 showed that it was not economically feasible to ripen and prepackage peaches in tomato prepackaging plants.

The West Virginia Agricultural Experiment Station, in 1954-55, showed that consumers preferred tree-ripened peaches to hard-mature peaches. When offered matched lots of tree-ripened peaches and hard-mature peaches at the same price, consumers chose 85 percent of their purchases from the tree-ripened peaches. When stores sold both tree-ripe peaches and hard-mature peaches--the regular commercial pack--total purchases of all peaches increased 50 percent. 1/

In 1955-56 researchers from the Agricultural Marketing Service and the West Virginia Agricultural Experiment Station conducted research on marketing tree-ripened peaches in cell-like consumer cartons holding 6, 8, and 10 peaches. These studies indicated that the consumer carton met with favorable trade reaction; however, the relatively high cost of packing peaches in cartons compared with the cost of packing them in the 3/4-bushel basket made the carton less acceptable from the shipper's viewpoint. A preliminary report showed that shippers received higher net returns for bulk-packing peaches than for prepackaging them. The economic feasibility of the cell-type carton was limited as follows:

1. Additional labor and time were required to pack the consumer cartons.
2. Additional container and packing equipment costs were substantial.
3. The differential between cost of packing and price received for prepackaged peaches was insufficient to encourage packers.

1/ Evans, H. C., and Marsh, R. S. Consumers' Reaction to Price of Tree-Ripe Peaches. W. Va. Univ. Agr. Expt. Sta. Cir. 95, May 1955.

During 1957, researchers from the Agricultural Marketing Service conducted experimental packaging and handling studies of the cell carton in order to develop and evaluate a satisfactory method of packaging firm-ripe peaches.

More prepackaged firm-ripe peaches were shipped during the 1957 peach season than in any previous year. The estimated 1957 total was approximately 34,000 master containers, each packed with 16 consumer units of 8 or 10 peaches. All prepackaged peaches observed in the Atlantic Coast States were shipped by motortruck. The majority of these trucks hauled mixed loads, usually being about 75 percent 3/4-bushel bulk containers, and about 25 percent master shipping containers of prepackaged peaches. Percentages of the prepackaged shipments by States were as follows:

	Percent
South Carolina	61.2
North Carolina	17.4
Virginia	14.6
Maryland	2.2
Pennsylvania	4.6

Approximately 75 percent of these prepackaged peaches were shipped to the New England States.

In 1958 an experimental prepackaging line was set up in a large Arkansas peach plant to experiment with new types of consumer packages. Workers were trained to select peaches of the proper quality and maturity for prepackaging, and to assemble, fill, and close five types of consumer containers.

Exploratory pre-test shipments were made of each of the packages. One controlled test shipment was made containing all five packages. A description of this preliminary experimental work in Arkansas may be found in the Appendix.

Need for Improved Packaging of Mature Peaches

Consumers prefer tree-ripened peaches over hard-mature ones and are willing to pay higher prices for them. However, because peaches are so perishable when ripe, commercial producers generally pack them while they are "hard" or "firm" for shipments outside the growing area. 2/ Hard fruit will ripen but will not be as large or as well flavored as if it were allowed to remain on the tree.

2/ In the definition of the United States Department of Agriculture Fresh Fruit and Vegetable Inspection Service, "hard" peaches will not yield to moderate pressure (as when squeezed with the thumb). "Firm" peaches yield very slightly to moderate pressure. Fruit at either the "hard" or "firm" stage of maturity is not yet edible.

In the past, peaches which ripened before they were harvested ordinarily were sold at sacrifice prices to local stores, roadside stands, or processors because they could not be shipped with safety. A container that would protect the quality of "firm-ripe" 3/ peaches all the way to distant markets and a way to pack it at a cost that was not prohibitive have long been a dream of peach growers and shippers. Consumers would benefit, too, because tree-ripened peaches taste better.

In addition to superior flavor, tree-ripened peaches have a more appealing, richer "ground" color. In the Southeast the less mature peaches of popular yellow varieties, such as the Golden Jubilee and Elberta, are green or light green while the more mature are turning yellow or are yellow. This "ground" color is not to be confused with the blushed, pink or red blush. Although the pink or red is often more striking on riper peaches, the color is not a reliable index of maturity because it varies with variety, area of production, weather conditions, and the like.

How Study Was Conducted

The program of research carried out in 1957 to develop and evaluate a more efficient and cheaper method of packaging tree-ripened peaches was as follows:

Seven packing plants were selected for observation in North and South Carolina. They were chosen on the basis of sales volume, location, and types of shipping containers used. The consumer package evaluated was a cell carton in 2 sizes, with 8 and 10 cells (cartons with individual cells for 8 or 10 peaches). The carton was packed in two types of master shipping containers: (1) a wirebound box and (2) a combination fiberboard and veneer master container. Each master container held 16 cell cartons.

The inside dimensions of both master containers were approximately the same and were about equal in volume to the 3/4-bushel basket. The 3/4-bushel basket was the most commonly used container in this area, and it was evaluated to provide a basis of comparison. Two of the seven plants studied used the combination fiberboard and veneer master container and five used the wirebound master container. All of the plants also packed in the 3/4-bushel baskets.

Experimental studies on the evaluation of the containers were conducted from July 1 to August 12, 1957. This report is based on results of these studies.

3/ "Firm ripe" means that the peach yields slightly to moderate pressure. The flesh is palatable but has not yet reached the prime eating stage.

The following information was obtained for the evaluation of the containers:

1. Costs of containers, labor requirements and costs of assembling, packing, and closing containers.
2. Condition of peaches and containers upon arrival in the terminal markets.
3. Consumer reaction to the prepackaged peaches through use of questionnaire cards placed in the cell cartons.

Limitations of Methods Used in Study

Although the seven peach packaging plants were chosen in an attempt to assure an adequate sample within the area in which the work was done, the plants were not necessarily representative of all peach packaging plants in the Southeast.

Another limitation was the relatively short time AMS observers could spend at each of the prepackaging plants. Because of the short season and the relatively few plants studied, the results presented can be no more than a comparison of methods and practices observed and evaluated. The evaluation of existing methods cannot substitute for the development of new techniques. It is hoped that this report will point the way to some improvements.

Practically no work was carried out at the retail level in determining the relative salability and cost of retailing prepackaged and bulk peaches. However, a consumer survey was made through the use of questionnaire cards.

Cost data collected on machinery and equipment were extremely limited. Comparative overhead costs at the various plants were not determined.

SHIPPING CONTAINERS AND CONSUMER PACKAGES STUDIED

Conventional 3/4-Bushel Basket

The 3/4-bushel basket is more generally used in the Carolinas for shipping bulk-packed peaches than the $\frac{1}{2}$- or full-bushel basket. It also holds almost exactly the same weight of peaches as the new master containers for prepackaged peaches. Therefore, it was selected for comparison with the new containers.

The 3/4-bushel container used was a tub basket with a stitched-in bottom. The sides were constructed of a minimum of 11 short veneer staves held in place by 4 hoops--1 inside and 1 outside at the top; 1 at the center and 1 at the top; 1 at the center and 1 at the bottom, both outside. The bottom was

either solid or built up of 7/16-inch veneer. This basket is identified as No. 8055 in the container and loading rules tariff No. 823-c of the Southern Freight Tariff Bureau (fig. 1). The tariff gives the minimum inside diameter at the top as 15 3/8 inches, the maximum outside diameter at the top as 16 7/8 inches, and the capacity as 1,612 cubic inches.

Neg. PMA 17863

Figure 1.--This is the conventional 3/4-bushel basket in which bulk peaches are shipped.

The basket had a separate cover, which was secured by a cross-slat extending across the top and forced through the two opposite wire handles looping up from the rim of the basket. The closure was further secured by two wire loop fasteners on the rim and spaced midway between the handles.

The 3/4-bushel basket had a tare weight of 2 pounds and was packed with about 40 pounds of peaches. Paper liners, cushions, or pads normally were used in packing the basket.

The tub basket was used for all bulk peach shipments observed in the Carolinas. It is the container in most general use throughout the Atlantic States and in Utah, Colorado, and Idaho.

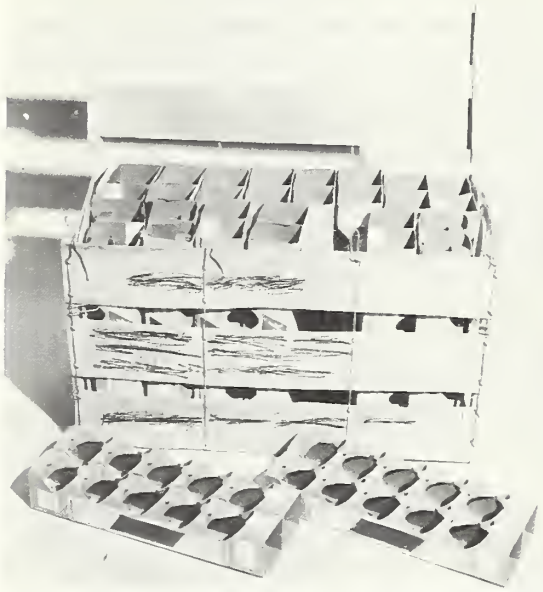
Chief advantages of the basket are in its comparatively low cost; most packing lines in the East are set up to handle it; and receivers are accustomed to it and find it easy to handle. It is easily packed. It is sturdy and gives adequate protection to hard-mature peaches, the kind ordinarily found in commercial channels. Empty 3/4-bushel baskets are easy to stack and store. Because of their shape, they nest or fit easily into each other, forming a solid stack when empty.

Peaches in the top center of the pack are often bruised by pressure on the cover from other baskets stacked above. The basket does not provide adequate protection for firm-ripe peaches. Protruding handles and wire fasteners often snag adjacent containers during loading and unloading.

Wirebound Master Shipping Container

The wirebound crate consisted of a blank and two end units. The blank included six veneer side slats (three for each side); two veneer bottom slats, two veneer top slats, four side cleats, four top and bottom cleats, and

four binding wires which were fastened to the veneer slats by wire staples. Each end unit included two veneer slats, two veneer strips, and a binding wire, the ends of which were extended and looped to lock into the blank (fig. 2).



Neg. N 24068

Figure 2.--Wirebound shipping container packed with 16 consumer cartons of peaches. Two 10-cell cartons are in foreground.

Two sizes of the wirebound crate were used in the 1957 peach season. The approximate inside dimensions of the larger crate were 21 1/4 by 10 1/4 by 12 3/8 inches; the smaller crate was 20 by 9 5/8 by 12 3/4 inches. The large crate held sixteen 8-cell cartons and the small crate sixteen 10-cell cartons.

The Package Research Laboratory's specification number for the larger crate was 56 - 16 and the smaller crate 56 - 15.

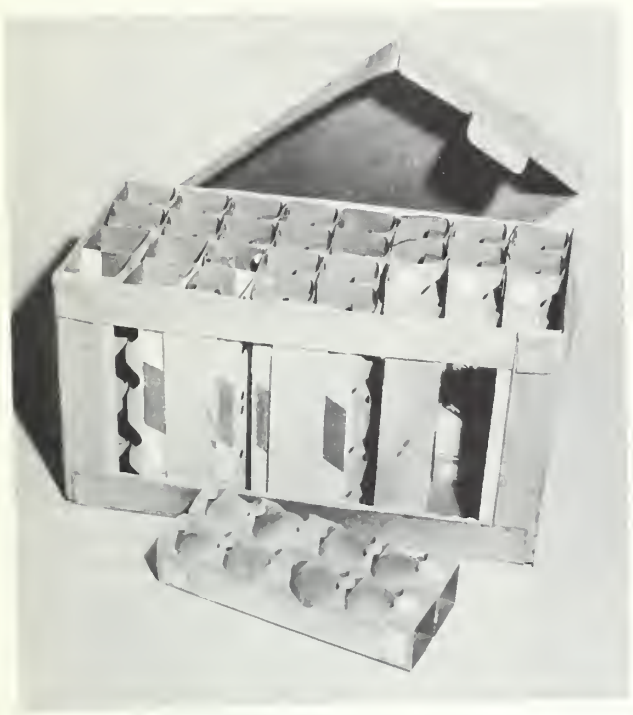
The wirebound crate containing the 8-cell cartons had a tare weight of 6 pounds and was packed with an average of 39.36 pounds of peaches. The tare weight of the crate for 10-cell cartons was also 6 pounds and it contained 39.90 pounds of peaches. The tare weight of both crates included 16 cell cartons.

Peach shippers of the Carolinas used wirebound crates only for prepackaged peaches. No shipments of bulk peaches in crates were observed.

Combination Fiberboard and Veneer Master Shipping Container

The combination fiberboard and veneer master container had two veneer side panels; each panel had five vertical veneer slats and two horizontal binding strips, one at the top and one at the bottom of the veneer slats (fig. 3).

A single piece of corrugated fiberboard formed both ends and the bottom of the container. The end pieces were overlapped two inches at the top for additional strength. Extended flaps on ends and bottom were overlapped and stitched to the veneer side panels. The one-fourth telescope cover was die-cut from a single piece of corrugated fiberboard. Two die-cut tabs extended



Neg. N 24069

Figure 3.--The new fiberboard and veneer master container for prepackaged peaches.

from the overlapped ends of the cover and interlocked with the overlapped ends of the container. The container was assembled with a stitching machine.

Two sizes of this container were used during the 1957 peach season. Both sizes contained 16 consumer cartons and had approximately the same inside dimensions as the wirebound crates. The tare weight of the container holding 8-cell cartons was 5.5 pounds, and the container held an average of 39.36 pounds of peaches. Tare weight of the container holding 10-cell cartons was also 5.5 pounds, and this container held 39.90 pounds of peaches. Tare weight of both containers included the weight of 16 consumer cartons.

This master container was introduced to the peach industry in the Carolinas during the 1957 peach season. It was used by the industry only for shipping prepackaged peaches, never for bulk peaches.

Consumer Cartons

The consumer cartons were die-cut at the manufacturing plant and delivered to the packinghouses as flats, which were assembled either semiautomatically or manually. The paperboard from which the cartons were made was treated on both sides to resist moisture. The assembled cartons had 8 or 10 cells, which were open at the top. Two round holes were punched in the bottom of each cell for drainage and ventilation. The sidewalls were solid, and a center partition separated the peaches into two rows (fig. 4). Crosswise partitions were punched out from the top and extended down about one-third the depth of the carton. Tabs extending from the tops of the cross partitions prevented the peaches from falling out.

The inside dimensions of the 8-cell cartons were 12 1/2 by 5 by 2 1/2 inches. The cells held peaches that had a minimum diameter of 2 3/8 inches; when packed, the carton weighed a minimum of 2 pounds. The inside dimensions

Neg. BN 5859

Figure 4.--Three consumer cartons are shown here. The one in the center is packed with 8 large tree-ripened peaches; the units on each side have 10 slightly smaller peaches.

of the 10-cell carton were 12 3/4 by 4 5/8 by 2 3/8 inches. The cells contained peaches that had a minimum diameter of 2 1/8 inches; the packed carton weighed a minimum of 2 pounds (fig. 4).

COST OF CONTAINERS AND PACKAGES

The master containers for prepackaged peaches cost considerably less than the conventional 3/4-bushel baskets. The wirebound crates cost about 38 cents each and the combination fiberboard and veneer containers, 42 cents, compared with approximately 52 cents for the basket. However, the cost of 16 consumer packages--about 60 cents--must be added to the cost of the new master containers; thus the total cost of the wirebound crate would be 98 cents, and the combination fiberboard and veneer container, $1.02.

The costs of the various containers in commercial lots of 1,000 are listed in table 1.

COST AND AMOUNT OF DIRECT LABOR FOR PACKING AND LOADING PEACHES 4/

In the packing sheds covered by this labor study, the only containers observed being packed with peaches were the standard 3/4-bushel basket holding aproximately 40 pounds of bulk fruit and master containers containing 16 prepackaged units, each of which held 8 or 10 peaches. The total weight of prepackaged peaches in the master containers was also approximately 40 pounds. This made the containers directly comparable on a net fruit per container basis.

Since this was a comparative study, only plant operations directly connected with packaging and packing were studied. Plant labor used for dumping, grading, sizing, defuzzing, cull handling, and supervision was not covered as it was identical for all containers packed in the same plant. The labor times used in this report have been adjusted to cover personal time and fatigue.

4/ Mark R. Enger, industrial engineer, formerly with the Agricultural Marketing Service, assisted in the preparation of this section and the following on method improvement.

Table 1.--Cost of containers and materials for prepackaged and bulk-packed peaches, North and South Carolina shipping points, 1957

Plant	Cost per 1,000 units in carload lots f.o.b. plants			
	Cell cartons 1/	Wirebound master container	Combination veneer & fiberboard master container	3/4-bushel basket 2/
	Dollars	Dollars	Dollars	Dollars
A	40.00	380.00	420.00	535.00
B	33.00	380.00	---	510.00
C	40.00	380.00	---	520.00
D	40.00	380.00	420.00	510.00
E	33.00	387.00	420.00	552.00
F	40.00	380.00	420.00	510.00
Average of all plants	37.66	381.25	420.00	522.83

1/ Cell carton costs represented here were actual costs of inventory that packer had at time AMS representative visited plant. Present costs for cell cartons are $41.60/1,000 delivered.

2/ Includes cost of liner, cushion or pads, and top. The cost of container varied slightly among shippers, because of slightly different types of baskets, different manufacturers, different liners and cushions, and different quantities purchased.

Operations Performed

In Packing 3/4-Bushel Baskets

Operations performed in packing peaches in the 3/4-bushel containers were as follows: (1) Preparing the top, or "face," layer of peaches, (2) filling the basket liner with fruit, (3) placing the liner full of fruit and the face layer in the basket, (4) adjusting the face layer, (5) hydrocooling, (6) placing lids and labels on the containers, and (7) loading the full containers on the truck.

Preparing the Face Layer.--A packer prepared the top, or face, layer of the basket by arranging peaches in a round metal plate called a "ring." The rim around the edge of the ring held the outer line of peaches in a circle. The "facer" usually placed one peach in position at a time with the right

hand while holding the previous peach in place with the left hand. The facer built from the outer circle toward the center until the center hole was reached and then filled the center hole with a few peaches selected for an exact fit (fig. 5).

Neg. N 6888

Figure 5.--Girls fit peaches in ring to form attractive face for bulk pack in 3/4-bushel basket.

Catching Fruit in Liner.--A paper basket liner was inserted into a metal mold, called a "tub." The mold was the shape of a basket; it was slightly larger at the top than at the bottom, and it was open at both top and bottom. The larger opening of the mold was placed down over the ring, which held a completed face layer of peaches. The mold, liner, face, and ring, as one unit, were placed under a chute and filled with peaches through the smaller mold opening, either manually or by a semiautomatic basket-filling machine. After being filled, the entire unit was moved to the main conveyor line and the mold was slipped off; the paper liner held the peaches in a mound on top of the face and ring.

Basketing.--Before basketing, most of the sheds had workers who added or shifted fruit at the top of the liner (actually the bottom layer after basketing). A basket was then placed down over the liner, which was holding the peaches mounded over the face. A device on the conveyor belt automatically turned the basket, ring, and face right side up simultaneously.

Adjusting Face Layer.--The ring, now inverted on the top of the basket, was removed and returned to the facers by an inclined wooden track, belt, or chain conveyor. In some sheds, workers at this point replaced green and blemished fruit and adjusted fruit on the basket face, whereas other sheds preferred doing this operation after hydrocooling. In a few sheds this operation was performed at both points.

Hydrocooling.--The basket was then placed on a conveyor that carried it to the hydrocooler. The fruit entered the hydrocooler with a pulp temperature which varied with the weather and the time of day the peaches were harvested. They remained in the hydrocooler about 15 minutes. Recommended temperature for peaches after hydrocooling is between 45 and 55 degrees.

Lidding and Labeling.--A basket lid and a pad were placed over the top of the basket to protect the face of the fruit. The wire handles were bent over the center stave of the lid, and the two wire ties on the top sides of the basket were pulled through wire loops on the lid and bent down tight with a handtool. A paper brand label was pasted on the side of the basket, and the fruit size, variety, and grade were stamped in ink on the lid.

Loading on Trucks.--The baskets were counted and conveyed or handtrucked to the loading dock. There they were loaded into a truck or stacked to await loading. This study concerned truck loading only as rail shipments of prepackaged peaches were not studied.

In Prepackaging Peaches and Packing in Master Containers

Operations performed in prepackaging 8 and 10 peaches in consumer cartons and then packing 16 consumer packages in a master container were as

follows: Making up cartons and containers, packing peaches in cartons and cartons in containers, hydrocooling, and loading on trucks.

Making Up Cartons and Containers.--The cell cartons were delivered from the factory flat and were punched into shape by a manually operated or semiautomatic machine. The master containers, which held 16 prepackaged units, were (1) a standard wirebound crate and (2) a combination fiberboard box with wood veneer slat sides.

The wirebound crate was delivered flat to the shed and there it was set up manually. A special tool was used by the workers to bend the wire loops that bound the corners into place.

The combination box was delivered in four pieces: A single piece of fiberboard to form the bottom and both ends, two slatted veneer side pieces, and a single piece of fiberboard to form the cover. Each veneer side was made of two horizontal slats to which were stitched five evenly spaced upright slats. To assemble the box, a worker forced the ends up at right angles to the bottom, inserted the veneer side pieces and bent the flaps on ends and bottom over the side pieces and stapled them with a semiautomatic machine. He bent the edges of the cover along scored lines to form a 2-inch flange or lip to fit over the box. The flange was single thickness on the sides and double on the ends, which were folded in and self locked in twin slits.

Packing Cell Cartons.--The cell cartons were packed by a worker who usually held the carton with one hand and with the other hand picked up peaches one at a time from a belt. The worker put the peach in a cell, and pressed lightly to nest it securely.

Packing Master Container.--Sixteen full cell-cartons were placed in each master container by hand. The lid of the wirebound master container was closed and secured by four wire ties. The fiberboard and veneer master container was left coverless until after hydrocooling.

Hydrocooling.--The filled master containers were placed on the conveyor to carry them to the hydrocooler. The packaged peaches remained in the hydrocooler the same length of time as the bulk peaches--about 15 minutes. The fiberboard and veneer master container was closed after its ice water bath. Flaps projecting from the lips of the lid were tucked under the folds or cuffs on the upper edges of the box ends to lock the cover in place. Brands and labels were printed on the containers before delivery to the packing plants.

Loading on Trucks.--In most plants the filled, covered, and labeled master containers were moved to the loading dock by conveyor. If a truck was waiting, a conveyor extension was set up to take the containers directly into it. If there was no truck waiting, the containers were stacked along the

loading dock. In one shed the master containers were hand-trucked--four at a time--to the loading dock. At most of the sheds supervisors made certain that when the trucks were loaded ample channels for ventilation were provided.

Labor Requirements

For Bulk Pack

The labor requirements for packing 3/4-bushel baskets of bulk peaches at seven different sheds in North and South Carolina are listed in table 2. These figures do not cover breakdown of equipment, time lost in changing lots of peaches of different varieties or from different growers, or in waiting for fruit to be supplied to the shed. Faulty scheduling or unbalance in the workload assigned to individuals in the production line often idled some of the workers. This time, lost while a worker waited for material or for completion of the preceding operation, is listed as unproductive time.

Table 2 shows that in packing 3/4-bushel baskets of peaches, the most time-consuming item was facing. This took an average of 1.71 man-minutes per basket. Another item that took considerable time was lidding and labeling, with an average of 0.92 man-minutes of work expended and an additional 0.55 man-minutes of unproductive time. Catching the fruit averaged 0.69 man-minutes.

Facing had no unproductive time charged against it because the packers worked as long as there was fruit before them and actually set the pace for the line beyond them. As mentioned previously, waiting for fruit was not covered. All of the remaining time items in table 2 had considerable unproductive time. Hydrocooling and loading had more unproductive time than productive time because of the unsteady flow of containers.

The average time required for packing the 3/4-bushel basket of peaches was 5.64 man-minutes. Among sheds, the time required ranged from a low of 4.77 to a high of 7.14 man-minutes.

For Consumer Pack

The most time-consuming step in the entire prepackaging operation was placing the peaches in the consumer cartons (table 3). It took an average of 10.15 man-minutes to pack 16 cartons, which held an amount of fruit equivalent to that packed in a 3/4-bushel basket. This was entirely a manual operation.

Assembly of consumer cartons and master shipping containers was next in labor requirements. Two very different methods of assembly were observed.

Table 2.--Labor required to pack a 3/4-bushel basket of peaches, 7 Carolina packing plants, 1957

Operation	Plant A	Plant B	Plant C	Plant D	Plant E	Plant F	Plant G	Average
	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.
1. Facing	1.77	1.63	1.60	2.16	1.54	1.36	1.92	1.71
2. Catching fruit	.79	.56	.53	.87	.67	.60	.73	.68
Unproductive 1/	.03	.09	---	---	---	---	---	.06
3. Basketing	.17	.53	.56	.20	.27	.30	.51	.36
Unproductive 1/	.15	.15	.15	.09	.17	.14	.23	.15
4. Adjusting the face	.29	.32	.20	.34	.18	.26	.35	.28
Unproductive 1/	.16	.16	.08	.23	.22	.09	.41	.19
5. Hydrocooling 2/	.15	.13	.13	.14	.14	.19	.14	.15
Unproductive 1/	.31	.20	.15	.24	.26	.16	.37	.24
6. Lidding and labeling	.73	.96	1.13	.71	1.12	.80	1.00	.92
Unproductive 1/	.91	.24	.22	.35	.39	.52	1.23	.55
7. Loading	.15	.22	.17	.15	.15	.16	.14	.16
Unproductive 1/	.31	.10	.11	.23	.25	.19	.11	.19
Total	5.92	5.29	5.03	5.71	5.36	4.77	7.14	5.64

1/ Time workers have to wait for material or for another worker to complete an operation before starting the work cycle again.

2/ Labor required to place basket in hydrocooler and to remove it from hydrocooler. Time for basket to move through hydrocooler is not included.

Table 3.--Labor required to pack peaches in 16 consumer cartons and pack cartons in 1 master shipping container, seven Carolina packing plants, 1957

Operation and method	Plant A	Plant B	Plant C	Plant D	Plant E	Plant F	Plant G	Average: By method or type of container	Average: For 7 plants
	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.	Man-min.
Make up 16 cell cartons from flats:									
Manual	---	3.55	2.18	---	1/2.94	3.28	2.75	2.94)	2.44
Machine 2/	1.18	---	---	1.18	---	---	---	1.18)	
Pack peaches in 16 cell cartons	8.05	9.22	10.30	10.98	11.12	9.34	12.05		10.15
Make up master container:									
Combination veneer and fiberboard 2/	1.45	---	---	1.45	---	---	---	1.45)	.75
Wirebound crate	---	.40	.51	---	1/.47	.46	.49	.47)	
Packing master container:									
Combination veneer and fiberboard	1.54	---	---	1.66	---	---	---	1.60)	1.87
Wirebound crate	---	1.93	2.01	---	2.47	1.54	1.92	1.97)	
Hydrocooling:									
Productive time	.16	.24	.15	.16	.12	.23	.15		.17
Unproductive time 3/	.30	.04	.13	.23	.27	.12	.35		.20
Loading:									
Productive time	.21	.20	.15	.19	.16	.28	.18		.20
Unproductive time 3/	.24	.12	.13	.19	.23	.07	.08		.15
Total	13.13	15.70	15.56	16.04	17.78	15.32	17.97	---	15.93

1/ This operation had been performed prior to the peach packing season and could not be observed at this plant. The average for the other plants using the same master container was used to complete the picture for this plant.

2/ The master containers and consumer cartons were assembled by automatic machinery at a central point and shipped to packingsheds--thus identical times for both. Automatic machines used for making cell carton and then hand-packed into master containers for shipment to peach packingsheds.

3/ Unproductive labor covers unbalance in the workload over the labor force where a worker has to wait for material or for another worker to complete an operation before starting his work cycle again.

All plants used the same consumer carton; five packed the cartons in wirebound crates; and two packed them in fiberboard and veneer boxes. The five plants assembled the cartons and crates manually adjacent to their packing lines. Cartons and boxes for the other two plants were assembled semiautomatically at a central warehouse and trucked to the plants. This warehouse and the two plants were under the same management.

It took an average of 1.18 man-minutes to assemble 16 cell cartons semiautomatically compared with 2.94 man-minutes to assemble them manually with the aid of a special punch. The overall average of all plants using both methods of assembling 16 cell cartons was 2.44 man-minutes.

The average time to assemble the fiberboard and veneer master container using a stitching machine was 1.45 man-minutes compared with an average of 0.47 man-minutes for the manual assembly of the wirebound master container. The overall average of assembling both types of master containers was 0.75 man-minutes.

The combined time required to assemble 16 cell cartons semiautomatically and 1 fiberboard and veneer master container by stitching machine was 2.63 man-minutes 5/ compared with 3.41 man-minutes to assemble 16 cell cartons manually with a special punch and 1 wirebound crate manually. The overall average time required to assemble 16 cell cartons and 1 master container for all plants, regardless of type of master container used or method of assembly, was 3.19 man-minutes.

After the consumer cartons were filled with peaches, it took an average of 1.60 man-minutes to pack 16 of them into the combination fiberboard and veneer master container, compared with 1.97 man-minutes to pack them into the wirebound master container. The average of all plants was 1.87 man-minutes. The time to pack 16 cell cartons in the combination fiberboard and veneer container was less than in the wirebound crate because of the ease of sliding the cartons into the container and the speed of closure.

Time for hydrocooling and loading did not differ materially among the containers used.

The master container, holding the same amount of prepackaged fruit as the 3/4-bushel basket, averaged 14.58 man-minutes for the fiberboard container and 16.46 man-minutes for the wirebound box. The overall average of all plants was 15.93 man-minutes. Among sheds, the time for packing the fiberboard master container ranged from 13.13 to 16.04 man-minutes and for the wirebound from 15.32 to 17.97 man-minutes. These figures included the time required to perform all the operations listed in tables 2 and 3.

5/ Time includes loading out the finished cartons at the assembling warehouse and unloading at the packing shed.

Labor Cost

The cost of direct labor to pack peaches in the various containers was based on a wage of 65 cents per hour, which was found to be the average rate in 1957 for the sheds studied. Labor cost to bulk-pack peaches in the 3/4-bushel basket was $0.06 compared with $0.16 to pack 16 cartons in the fiberboard master container and $0.18 to pack the wirebound master container.

COMPARATIVE COSTS OF PREPACKAGING AND PACKING IN BULK

Materials and labor costs to prepackage peaches were twice as high as similar costs for bulk-packing peaches in 3/4-bushel baskets.

Total materials and direct labor cost for the master containers packed with 16 cell cartons was $1.16 to $1.18, depending on the master container used, compared with the equivalent cost of 58 cents for bulk peaches in the 3/4-bushel basket (table 4).

Table 4.--Costs of labor and materials for prepackaging and packing peaches in specified containers, compared with bulk-packing in 3/4-bushel baskets, Carolina shipping points, 1957

Item	Prepackaged 1/		Bulk, 3/4-bushel basket
	Veneer and fiberboard master container	Wirebound master container	
	Dollars	Dollars	Dollars
Labor cost 2/	0.16	0.18	0.06
Materials cost	3/1.02	3/.98	.52
Total labor and materials cost	1.18	1.16	.58

1/ In 16 cell cartons for each master container.
2/ Based on average wage rate of 65 cents per hour.
3/ Includes 60 cents for 16 cell cartons.

The cell cartons cost about 3.75 cents each, or 60 cents for the 16 packages that went into one master container. The combination veneer and fiberboard master container cost 42 cents, and the wirebound master cost 38 cents. The 3/4-bushel basket cost 52 cents with liner, cushion, or pads.

Although materials costs for the wirebound crate were 4 cents lower than for the fiberboard and veneer container, labor costs for packing the wirebound were 2 cents higher. Labor for packing the 3/4-bushel basket was considerably less than for either of the other two; 6 cents, compared with 16 cents for the combination container and 18 cents for the wirebound.

Thus, it cost 58 to 60 cents more to pack 3/4 bushel of peaches in cell cartons, depending on type of master container used, than to pack the 3/4-bushel basket. These were direct materials and packing labor costs. Indirect costs, such as those for providing additional space and tighter quality control for the prepackaging operation, were not determined.

SUGGESTED CHANGES IN PACKING METHODS

Bulk-Packing in 3/4-Bushel Baskets

Baskets had been the conventional shipping container for fresh peaches in the Southeastern States for a long time. As a result, the packing operations reflected the accumulated improvements over the years. One recent improvement was the mechanization of the basket-filling operation. Most sheds employed modern assembly-line techniques. Individual operations appeared highly efficient. Efforts could be made, however, to reduce the amount of unproductive labor time. The following approaches merit consideration:

1. More thorough repair of equipment before the season and during nonoperating hours in order to cut breakdown time.

2. Advance planning to reduce the time lost in shifting from one lot of peaches to another.

3. Reorganization and reassignment of tasks to attain better balance and more flexibility in the packing line. An example of what might be accomplished by a more flexible working force follows:

Observations in the various plants indicated that when a poor run of fruit was encountered, the dumping of peaches into the packing lines was slowed down. This was done to give the graders additional time to remove a greater proportion of culls. The reduced volume of peaches entering the line and the greater number of culls removed cut sharply into the flow of fruit to the packers. Unproductive time rose rapidly all along the line as workers were compelled to wait for peaches. With a more flexible organization of tasks the grading station could be reinforced to maintain a steady flow of peaches.

Packaging in Cell Cartons

As the use of cell cartons for prepackaged peaches was a recent development, many sheds had set up prepackaging operations on a pilot plant basis with limited commercial production. In consequence, changes in plant layout and several changes in methods might be made advantageously. The operation that consumed the most time--that of placing peaches in the carton--was chosen for the study.

The study approach used was "methods-time measurement" which is defined as "a procedure which analyzes any manual operation or method into the basic motions required to perform it and assigns to each motion a predetermined time standard which is determined by the nature of the motion and the condition under which it is made." 6/ This type of analysis is especially desirable for spotting inefficiencies in methods, thus setting the stage for improvement.

The most common work method of packing 10 peaches in a cell carton--as observed in the packingsheds in the Carolinas during 1957--was as follows:

At start of cycle the packer's left hand is idle in front of him. After discarding a full carton, he reaches approximately 16 inches with his right hand for an empty 10-cell carton, grasps the carton, and places it in front of him. With his left hand he holds the carton securely on the platform while reaching 24 inches for peaches with his right hand. On the average, approximately half of the peaches (or 5 for each carton) come singly on the belt; the other half are jumbled in groups on the belt. The packer's reach for a peach in a group is a fraction slower than his reach for a single peach because he is deciding which peach to select; and the grasping of a peach in a group is considerably slower because his fingers must push between unwanted peaches to pick up the wanted peach. Thus, five times (for one carton) the packer reaches with his right hand for a peach standing alone. Also, five times his right hand reaches a trifle more slowly for a peach in a group and grasps it considerably more slowly. With his right hand he moves a peach 24 inches from belt to carton, positions the peach over cell in which it is to be placed, presses the peach into the cell, and releases the peach. He repeats this operation 10 times. After the 10th peach has been placed in the carton, the packer grasps the full carton with his right hand, moves the carton 8 inches, and drops it on the conveyor belt. The complete cycle requires 819.9 time measurement units, or 29.5 seconds per carton of 10 peaches (table 5). 7/

6/ Maynard, Harold B., Stegemerten, G. J., and Schwab, John L. Methods-Time Measurement. 292 pp. New York. 1948. (p. 12.)

7/ A time measurement unit (TMU) is an arbitrarily chosen unit of measurement equivalent to 0.0001 hour. This unit was chosen because the original standard data were derived from motion picture studies and the unit of time, 1/16 second, was undesirable for calculations.

Table 5.--Analysis of actions performed and time required to pack peaches in 10-cell carton by method used most, seven packing plants in North and South Carolina, 1957

Actions performed by left hand	Times left hand performs action	Predetermined time standard 1/	Times right hand performs action	Actions performed by right hand
	Number	Seconds	Number	
Idle		0.6	1	Reach for empty carton
Do.		0.1	1	Grasp carton
Reach to carton	1	0.8	1	Move carton to workbench
Grasp carton	1	0.2		Release carton
Hold carton		3.9	5	Reach for single peach
Do.		4.0	5	Reach for peach in group
Do.		0.4	5	Grasp single peach
Do.		1.3	5	Grasp peach in group
Do.		9.2	10	Move peach to carton
Do.		2.0	10	Position peach over empty cell
Do.		5.8	10	Press peach into cell
Do.		0.7	10	Release peach
Release carton	1	0.2	1	Grasp carton
Idle		0.3	1	Move carton to conveyor and drop
Total for cycle		29.5		

1/ These are not observed times but are predetermined time standards converted from time measurement units at the rate of 0.036 seconds per TMU. When right and left hands perform different actions simultaneously, the action requiring more time is recorded.

The preceding description of the prepackaging operation showed that the right hand was doing all the productive work while the left hand did nothing but hold the carton. The problem then was to free the left hand and to make it available for productive work. A fixture or holding device for the carton was one answer. Research workers devised a simple fixture shown in figure 6, to hold the carton while it was being filled.

The outer rim of the fixture was made of boards about 1-inch thick with the bottom on a level with the conveyor belt so that the cell carton could be slid out on the line after being filled. The side rims of the fixture flared out, and the size of the opening was such that an empty cell carton could be

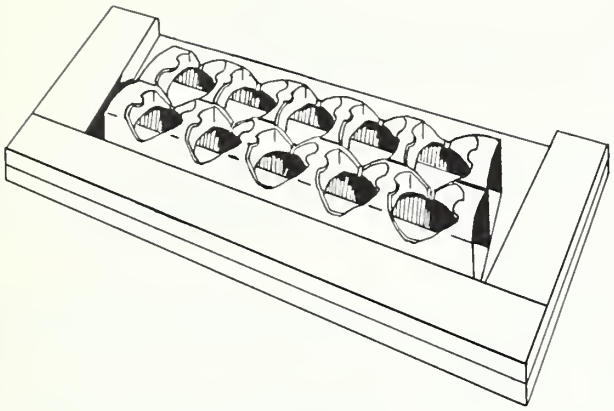


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Figure 6.--This simple wood fixture holds the cell carton in place while it is being packed with two hands.

slid into place easily. The main purpose of the device was to hold the carton so that it would not move appreciably during placing of the peach, and thus the operator could use both hands for packing.

An improved method using the fixture shown in figure 6 would have a work cycle as follows:

Using his left hand, the packer moves the packed 10-cell carton out of the fixture, which is directly in front of him, onto the conveyor belt. At the same time, he reaches 24 inches with his right hand for an empty carton, grasps the carton, moves it 24 inches, and places it in the fixture. With both hands he reaches about 24 inches for peaches, moves the peaches to the carton, and places them in cells; he repeats these motions five times. As described in the usual method of packing peaches, half the peaches reach the packer in groups, and the packer takes more time to reach for and grasp them than he does the single peaches. The packer reaches for the peaches and moves them to the carton with both hands simultaneously. But to avoid injuring the fruit, he does not move his hands simultaneously when he grasps the fruit nor when he places the peaches in the cells. He places one peach in a cell, and as he releases that peach, he begins to press the other peach into its cell. After he has packed five peaches with each hand, he slides the full carton onto the conveyor belt with his left hand and reaches for an empty carton with his right hand to start a new cycle. The cycle requires 536 time measurement units, or 19.3 seconds, per carton of 10 peaches (table 6).

As can be seen by the preceding description, both hands do useful work simultaneously a great deal of the time. Packing the consumer carton should, therefore, take about one-third less time by the improved methods than by the conventional method. After a packer has developed proficiency in following it, the improved plan of operation will be set up and evaluated under commercial conditions.

The second most time-consuming element consisted of making up cell cartons at the packing plants. A machine that is now on the market automatically punches out the cell cartons much faster than any of the manual operations observed. The automatic machine punches out 16 cartons in 0.36 minutes. To

Table 6.--Analysis of actions performed and time required to pack peaches in 10-cell carton, by improved method

Action performed by left hand	Times left hand performs action	Predetermined time standard 1/	Times right hand performs action	Action performed by right hand
	Number	Seconds	Number	
Move full carton to conveyor	1	0.8	1	Reach for empty carton
Release full carton	1	0.1	1	Grasp empty carton
		0.8	1	Move carton into fixture
		0.1	1	Release carton
Reach for peach	5	4.0	5	Reach for peach
Grasp peach 2/	5	0.4	5	Grasp peach 2/
		1.3		
Move peach to carton	5	4.6	5	Move peach to carton
Position peach over cell	5	1.0	5	Position peach over cell
		2.9	5	Press peach into cell
Press peach into cell	5	2.9	5	Release peach
Release peach	5	0.4		
Contact grasp carton	1	0		
Total for cycle		19.3		

1/ These are not observed times but are predetermined time standards converted from time measurement units at the rate of 0.036 seconds per TMU. When left and right hands perform different actions simultaneously the action requiring more time is recorded.

2/ Grasping peach standing alone on belt requires 0.4 seconds, compared with 1.3 seconds for grasping a peach in a group.

punch them out manually, workers take 2.94 minutes per 16 cartons. There is a potential labor saving of 2.94 minus 0.36 or 2.58 minutes per 16 cartons, the equivalent of one full master container.

The following figures show the number of master containers a plant must fill with peaches prepackaged in cell cartons to pay for an automatic machine costing $2,500 through labor savings, when wage rates are as indicated:

Wage rate	Number of master containers
65 cents	89,000
100 cents	58,000
150 cents	39,000

From these figures a plant operator can tell approximately the amount of time necessary to repay his initial investment through anticipated volume of prepackaging.

Assume that a plant uses 2,000 3/4-bushel baskets a day and pays a wage rate of 65 cents an hour. If this plant packs 25 percent of its peaches in cell cartons, or 500 master containers a day, it will take approximately 2 1/2 seasons to pay for the machine. If the plant packs 50 percent in cell cartons, or 1,000 master containers a day, it will take approximately 1 1/3 seasons to pay for the machine. At a 75 percent rate, or 1,500 master containers a day, the machine can be paid for within one packing season.

The third most time-consuming operation was that of packing the consumer cartons into the master container. While the master container was being packed with cell cartons it was placed in 3 different positions in the plants observed. A few plants packed the cartons into containers that were in a horizontal position, most packed them into containers that were sitting on end in a vertical position, and one used a tilted table fixture (fig. 7) to hold the master container during packing.

In both the horizontally and vertically placed master container, occasional cartons fell over or tended to work out of position, thus added labor was required to keep them in place. The tilt of 20° to 30° held the cartons in place in the tilted container and freed both hands for working with the packages.

COST OF TRANSPORTING CAROLINA PEACHES TO TERMINAL MARKETS

During the 1957 season trucks moved most of the Carolina peaches. Hence, when transportation costs were computed for this report, rail charges were not considered.

Refrigeration

With few exceptions the trucks observed in this study used the bunker-blower type of refrigeration. At the start of the haul about six blocks of ice, each weighing approximately 300 pounds, were broken into pieces and dropped into bunkers in the forward end of the truck body. Fans operated by a small gasoline engine circulated air through the ice and around the load of peaches. From four to five blocks of ice were added about every 6 hours the truck was on the road.

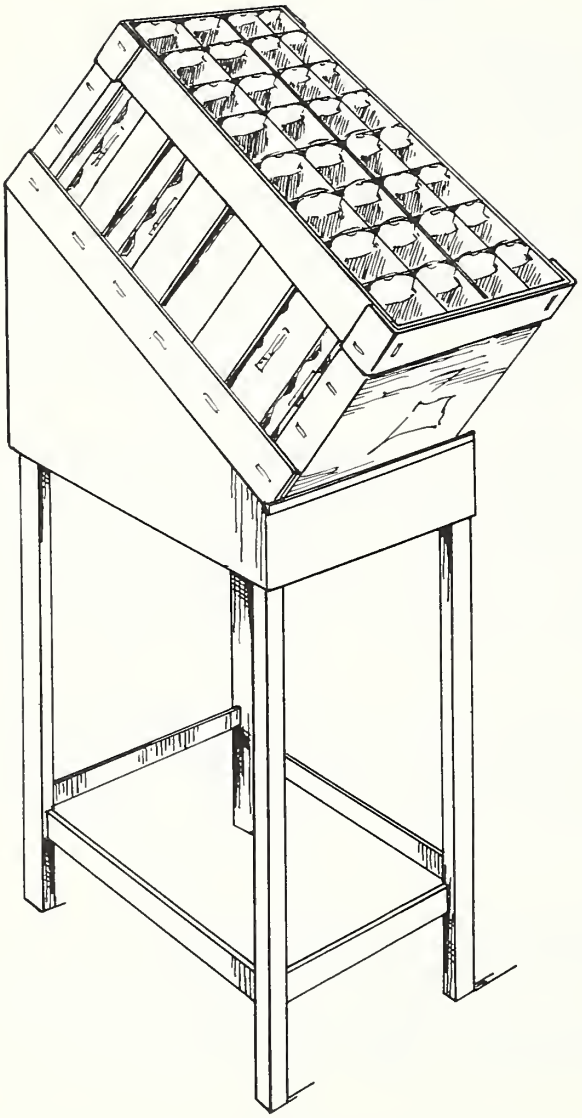

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Figure 7.--The tilt of this special stand prevents consumer cartons from tipping over or sliding out of place while being packed in master container.

On a typical haul from central South Carolina to Boston, Mass., a distance of about 900 miles, the trucks required an average of 23 blocks of ice, or 6,900 pounds. At a rate of $1.50 per block, this represented an average cost of $34.50. This cost might be higher or lower, depending on distance peaches were shipped, outside temperature, and insulating qualities of the truck body. The cost of refrigeration is included in truck transportation cost.

Trucking Charges

Trucking charges were the same on a per unit basis for the baskets, the crates, and the boxes. The large tractor-trailer, generally used, hauled an average of 625 units regardless of the type of the master container.

In this study 14 shipments of prepackaged and bulk peaches were inspected for condition upon arrival in 5 terminal markets. Average charges reported paid by growers and shippers for transportation of their peaches from Spartanburg, S. C., to these markets on a per basket, box, or crate basis were as follows:

To	Cents per unit
Detroit, Mich.	85.0
Boston, Mass.	82.5
Providence, R. I.	82.5
Nashville, Tenn.	75.0
Carlstadt, N. J.	70.0

WHOLESALE PRICES OF BULK AND PREPACKAGED PEACHES

Wholesale prices of bulk peaches and prepackaged peaches in 68 mixed shipments in 1957 were obtained. The prices received for the prepackaged peaches were consistently higher.

The bulk peaches were sold in 3/4-bushel baskets. The prepackaged peaches were sold in two types of master containers each holding 16 cell cartons; the cartons held either 8 or 10 peaches. Peaches in both the baskets and the master containers had a net weight of approximately 40 pounds. Peaches in the baskets had a minimum diameter of 2 inches. The minimum diameter of peaches in the 10-cell cartons was 2 1/8 inches, and in the 8-cell cartons 2 3/8 inches. The peaches in each shipment were of the same variety and of comparable quality. The prepackaged peaches were riper than those in the baskets.

All shipments originated in the Carolinas; the first was shipped on June 26 and the last, August 20. Although prices fluctuated, they tended to go down after the middle of July.

Prices received for master containers with 16 cartons of 10 peaches were the same as for master containers with 16 cartons of 8 slightly larger peaches. There was no price difference between the wirebound crates and the fiberboard and veneer container.

Prices for master containers of prepackaged peaches ranged from a low of $3.75 to a high of $7. For the 3/4-bushel baskets of bulk peaches the price ranged from $2.50 to $6.25.

In 67 of the 68 shipments, the prepackaged peaches brought a higher price than the bulk peaches. In one shipment the bulk and the prepackaged peaches sold for the same price. The premium paid for the prepackaged peaches ranged from $0.25 to $1.50, and averaged $0.73.

EVALUATION OF PEACHES AND CONTAINERS AT TERMINAL MARKETS 8/

Approximately 60 truckloads of prepackaged firm-ripe peaches were packed and shipped in cell cartons during the 1957 season. Fourteen shipments were inspected at terminal markets: Eight at Providence, two at Boston, two at Detroit, one at Nashville, and one at Carlstadt, N. J. Most of these shipments originated in Spartanburg County, S. C.

8/ Theresa Kelleher, mathematical statistician, Division of Statistical Control, AMS, supervised the statistical analysis of the differences in amounts of bruising damage to peaches.

All shipments inspected included both bulk and prepackaged peaches. The bulk peaches in all shipments were packed in 3/4-bushel baskets. In eight shipments the cell cartons of prepackaged peaches were all packed in wirebound crates; in four shipments the cartons were packed in both wirebound crates and in combination fiberboard-veneer boxes; and in two shipments the cartons were packed only in the combination boxes. Thus, in the entire 14 shipments the wirebound crates were observed 12 times and the combination boxes 6 times.

In 7 shipments the wirebound crates were packed in two different ways: With 16 cartons each containing 10 peaches and with 16 cartons each containing 8 peaches. In 4 shipments the wirebound crates were packed only with the 10-cell cartons, and in 1 shipment the crates were packed only with 8-cell cartons. Thus, in the wirebound crates the consumer cartons of 10 peaches were observed 11 times and the cartons of 8 peaches were observed 8 times.

In 3 shipments the combination fiberboard and veneer boxes were packed only with 10-cell cartons; in 2 shipments they were packed with both 10-cell cartons and 8-cell cartons, and in 1 they were packed with 8-cell cartons only. Thus, in the combination boxes the 10-peach carton was observed 5 times and the 8-peach carton 3 times.

Bruising of Peaches 9/

In 8-Cell and 10-Cell Consumer Cartons

There was a considerable difference between the amount of bruising of prepackaged peaches in relation to the size of the peaches. More bruising was found in the 8-cell cartons than in the 10-cell cartons, in both the wirebound crates and in the combination boxes. The peaches in the 8-cell cartons were larger--approximately 2 3/8 inches in diameter compared with 2 1/8 inches in the 10-cell cartons.

When observations on the peaches in both the crates and the boxes were averaged together, the slight bruising of peaches in the 8-cell cartons was 11.7 percent and in the 10-cell cartons 7.8 percent. Damage by bruising was 5.9 percent in the 8-cell cartons and 4.0 percent in the 10-cell cartons. Serious bruising was 1.9 percent in the 8-cell pack and 1.4 percent in the 10-cell pack (table 7).

9/ Designation of bruising as slight, damage by bruising, or serious depends upon the area and depth of the bruise as well as the extent of discoloring. In general, the following guide was used: Bruised area less than 3/4 inch in diameter, slight bruising; 3/4 to 1 inch, damage by bruising; over 1 inch, serious bruising.

Table 7.--Bruising of peaches observed upon arrival in terminal markets, 14 shipments, 1957

Type of container and method of packing 1/	Shipments	Bruising		
		Slight	Damage	Serious
	Number	Percent	Percent	Percent
Wirebound crate:				
16/8's	8	12.1	5.9	1.8
16/10's	11	7.4	3.7	1.5
Average	---	9.4	4.6	1.6
Fiberboard-veneer box:				
16/8's	3	10.5	6.0	2.1
16/10's	5	8.8	4.8	1.2
Average	---	9.4	5.2	1.5
Average of crates & boxes:				
16/8's	9	11.7	5.9	1.9
16/10's	14	7.8	4.0	1.4
Average	---	9.3	4.7	1.6
3/4-bushel baskets, bulk	14	12.9	5.8	3.4

1/ 16/8's means a pack of sixteen 8-cell cartons, 16/10's, a pack of sixteen 10-cell cartons.

Differences in the slight bruising of larger peaches and smaller peaches were statistically significant at the 1-percent level; differences in the damage by bruising were significant at the 5-percent level; differences in serious bruising were not significant.

Although the skin coloring and degree of firmness at packing time seemed to indicate the same degree of maturity, the 2 3/8-inch peaches probably were slightly more mature than the 2 1/8-inch peaches. This small degree of added maturity could have made the larger peaches more susceptible to bruising.

In the bulk packs larger peaches also tended to bruise with greater frequency than the smaller peaches.

In Crates and in Boxes

When the amounts of bruising of prepackaged peaches in both the 8-cell cartons and the 10-cell cartons were averaged together, differences in the percentage of bruising in the wirebound crates and in the combination fiberboard and veneer boxes were not significant.

Slight bruising of the peaches averaged 9.4 percent in both the crates and the boxes. Damage by bruising in the crates was 4.6 percent and in the boxes, 5.2 percent. Serious bruising was 1.6 percent in the crates and 1.5 percent in the boxes.

In Cartons and in Bulk

Since no differences were found between the bruising of prepackaged peaches in the wirebound crates and in the combination fiberboard and veneer boxes, percentages for the two master containers were averaged for comparison with the single bulk container. However, there were differences in bruising between the two sizes of consumer containers. Therefore, the amount of bruising in each size averaged for both the crates and boxes was compared with the bruising in the bulk-packed 3/4-bushel basket.

The bulk pack had significantly more bruising of all classifications than the 10-cell cartons of peaches. Slight bruising was 12.9 percent in the baskets and 7.8 percent in the 10-cell cartons; damage by bruising was 5.8 percent in the baskets and 4.0 percent in the 10-cell cartons; serious bruising was 3.4 percent in the baskets and 1.4 percent in the 10-cell cartons.

There was slightly more bruising in the bulk baskets than in the 8-cell cartons of prepackaged peaches. However, the differences were too small to be significant except in the serious bruising classification.

The overall advantage in favor of the prepackaged peaches was noteworthy because they were considerably more mature than the bulk peaches, hence more susceptible to bruising.

From Different Shippers

The amount of bruising among the lots of peaches packed by the various shippers differed noticeably. Slight bruising ranged from 5.4 percent to 16.5 percent, damage by bruising from 2.4 to 8.0 percent, and serious bruising from 0.5 percent to 3.5 percent (table 8). These percentages were averages of both bulk and prepackaged lots. The differences in slight bruising and in damage by bruising were statistically significant.

Table 8.--Condition of Carolina peaches upon arrival in terminal markets, by shippers, 1957

Shipper	Lots	Bruising 1/		
		Slight	Damage	Serious
	Number	Percent	Percent	Percent
A	20	11.1	5.9	2.4
B	4	8.6	4.0	2.3
C	6	16.5	6.4	2.2
D	6	12.1	8.0	3.5
E	4	5.4	2.4	0.5
F	4	9.0	3.7	1.7
G	4	9.0	4.3	1.7

1/ Average of bulk and prepackaged lots in all containers.

The differences were due to a number of factors, including (1) different packing methods and procedure; (2) degree of quality control maintained within the plant; and (3) care in handling, stacking, and loading containers. The superior condition of the peaches from plant E reflected the management's insistence on quality control and care in handling from the time the peaches were delivered to the plant until they were shipped.

As previously noted, the variation of peach bruising among shippers was based on an average of bulk and prepackaged lots. The results indicated the degree of overall efficiency as noted during studies in the different packing plants. So that the shipper's ability to prepackage peaches could be evaluated and variations caused by the size of the peaches could be eliminated, the bruising records for the 10-cell cartons were analyzed separately.

Again, plant E showed up best. Its peaches suffered almost 50 percent less slight bruising and damage by bruising than the peaches from the other plants, and the serious bruising was a scant 0.3 percent.

Condition of Containers on Arrival

Researchers examined all three types of master containers after shipment by truck from the Carolinas. The 3/4-bushel basket was commonly used throughout the Atlantic States. It was included in this study of new containers for prepackaged peaches to provide a basis of comparison for the wirebound crates and fiberboard and veneer boxes.

Wirebound Master Container

Container damage resulting from wire breakage and split or broken veneer strips was very slight. This container had a tendency to sag in the center when wet; however, no significant bruising damage was apparent as a result of this flexibility.

A shift of load during transit in two shipments damaged several containers on the bottom layers. This container damage, however, caused very little bruising damage to the peaches, no doubt because of the additional protection afforded by the carton.

Combination Fiberboard and Veneer Container

All master containers became wet when the peaches packed in them were hydrocooled. Usually the containers were loaded into trucks while still wet. If the load was properly stacked and well ventilated, the fiberboard dried out and the containers arrived at terminal markets in good condition. When ventilation was inadequate, moisture soaked into the fiberboard and weakened it. This was especially true on the bottom layers where the largest concentration of moisture was found.

In two shipments the veneer side strips cut through a few damp fiberboard bottoms and the contents fell out when the containers were picked up, unless special care was used. When containers were stacked five high and cross-tied together with part of the containers placed lengthwise of the truck and part crosswise, less container damage was observed.

In this method of loading, the direction of the containers is reversed from layer to layer or from stack to stack. For example, the containers in the bottom, middle, and top layers may be loaded lengthwise of the truck, and those in the second and fourth layers crosswise at right angles to the containers in the other layers.

Bulk Container

All shipments of the 3/4-bushel basket arrived at destination in good order. In several shipments, there was a shift of load which, however, resulted in very little damage to the baskets.

Consumer Carton

This container was packed in both crates and boxes. Even though the master containers were sometimes weakened by excess moisture or damaged by a

shift of the load, the cell cartons gave excellent protection to the peaches. Only in the more serious types of damage to master containers were the cartons crushed. The cartons were treated for moisture resistance to withstand immersion in the hydrocoolers. No difference was observed in the performance of the 8-cell and the 10-cell cartons.

REACTION OF TRADE AND CONSUMERS TO NEW CONTAINERS

Wholesale Trade

All peaches observed in terminal markets were unloaded at chainstore warehouses. Without exception, officials responsible for receipt and distribution of the shipments first commented on the quality and condition of the fruit rather than on the containers.

The superior condition of the prepackaged peaches impressed all the officials interviewed. They also were quick to note that the deeper coloring of the prepackaged peaches--as a consequence of added maturity--made them more attractive than the bulk peaches.

All commented on the good protection provided for the peaches by the cell carton, and most felt the cartons displayed the peaches well. Some said that better visibility was needed, but that visibility should not be increased at the expense of protection. Some also thought the opening of the carton should be made easier or, failing that, the instructions on how to open should be made more prominent.

In two shipments a few combination fiberboard and veneer master containers near the bottom of the load failed to dry out after hydrocooling and were delivered in a wet and weakened condition. These were singled out for adverse criticism. When they arrived dry--as they usually did--they elicited praise as attractive, sturdy, and easy to open, handle, and stack.

Most of the receivers liked the appearance, stacking, and handling qualities of the wirebound crates. Although they appeared to protect their contents adequately, some receivers felt the crates looked too flexible for peaches.

Consumers

One of the most important problems to solve in the development of a market for any new product or in the evaluation of any new type of container is to determine the reaction of consumers. It is also important to determine as quickly as possible what the consumer likes or dislikes about the new

product and the new container so that either can be changed early in the development program. Consumer reaction to firm-ripe peaches packed in the cell carton was determined by questionnaire cards which were inserted in the cartons.

Method Used to Determine Reaction

Approximately 34,000 consumer questionnaire cards were inserted in the cell cartons in 6 packing plants in North and South Carolina. The cards were color-coded to show date packed and plant where packaged. The size of the cards was 2 3/4 by 5 1/2 inches.

The questionnaire is shown below:

1. Did you like these prepackaged peaches? ..... Yes ☐ No ☐
   Why? _____
   _____

2. Did you find these peaches in good condition? ..... Yes ☐ No ☐
   If "No," what was wrong with them? Over-ripe ☐ Too green ☐ Decayed ☐ Bruised ☐
   Other _____

3a. Was the container damaged in any way? ..... Yes ☐ No ☐
 b. Was it difficult to remove the peaches? ..... Yes ☐ No ☐
 c. Would you prefer more visibility in the container? ..... Yes ☐ No ☐
    (Greater visibility may mean less protection)

4. Date purchased _____ 5. Price paid _____

6. City _____ 7. State _____

Of the 34,000 cards inserted into the consumer cartons, 2,769 were filled out and returned, approximately an 8 percent return.

Pertinent information was available early in the peach season. These early findings on what the consumer liked and disliked about the prepackaged peaches encouraged the shippers to improve quality control.

Most of the Carolina prepackaged peaches were shipped to New England States, and as a result, most of the cards returned were from that area. Cards were returned, by States, as follows:

	Number
Massachusetts	1,737
Rhode Island	285
Connecticut	179
Maine	156
New Hampshire	128
Ohio	122
Michigan	112
North Carolina	25
Vermont	15
South Carolina	2
Tennessee	2
Georgia	1
Mississippi	1
New Jersey	1
New York	1
Kentucky	1
Washington, D. C. ...	1
	2,769

Consumers' Replies to Questions

The questions asked and the replies received were as follows:

1. "Did you like these prepackaged peaches?"

	Number	Percent
"Yes"	2,548	92
"No"	221	8

"Why?"

Reasons given by consumers who liked them:

	Number	Percent
"Quality"	866	34
"Convenience"	331	13
No comment or various	1,351	53

Listed under "Quality" were such answers as: "The peaches were ... juicy and sweet ... firm and tasty ... simply beautiful and delicious ... wonderfully flavored ... not bruised or marked in any way."

Listed under "Convenience" were such comments as: "Easy to store in refrigerator ... easy to handle ... no trouble to carry ... could see at a glance just what I was buying."

Most of the respondents answering "No" to question No. 1 gave no reason or merely stated "See below" and listed reasons under question No. 2.

2. "Did you find these peaches in good condition?"

	Number	Percent
"Yes"	2,427	88
"No"	238	9
No comment	104	3

"If "No" what was wrong with them?"

Summary of detailed comments from respondents on the condition of the peaches:

	Number	Percent
Overripe, decayed, or bruised	311	11.2
Too green or hard	94	3.4
Other reasons	60	2.2
No comment	2,304	83.2

Seventeen percent of the respondents criticized the peaches they received even though some of them had replied that peaches were in good condition when purchased. Several typical comments which help to explain these criticisms follow: "Not quite ripe enough." "There were a few soft spots." "Eight peaches excellent, 2 too green." This seemed to indicate that while a number of consumers considered the peaches to be in good condition, they wanted to point out that they were not perfect.

3a. "Was the container damaged in any way?"

	Number	Percent
"Yes"	30	1
"No"	2,700	98
No comment	39	1

3b. "Was it difficult to remove the peaches?"

	Number	Percent
"Yes"	1,113	40
"No"	1,403	51
No comment	253	9

Instructions for removing the peaches were printed on the bottom of the containers and may have been overlooked by many respondents until they had removed some of the peaches. The bottom is perforated along each side and can be opened quite easily. Several consumers replied that they did not notice the perforated bottoms and opening instructions until they had purchased their second or third carton of peaches.

3c. "Would you prefer more visibility in the containers? (Greater visibility may mean less protection.)"

	Number	Percent
"Yes"	305	11
"No"	2,222	80
No comment	242	9

4. "Date purchased."

The average length of time peaches were in marketing channels was 6 days.

The time peaches were in marketing channels was figured from date shipped from packing plant to time of purchase by the consumer. All prepackaged peaches observed being shipped from the Carolinas went by truck. Transportation time from peach growing centers in South Carolina to Boston and Providence, the principal markets, was approximately 30 hours.

5. "Price paid."

The average price paid for the cell carton was 47 cents. There was usually no difference in the price paid by consumers between the 8-cell and 10-cell carton of peaches in any given area. Peaches packed in the 8-cell carton were slightly larger than those packed in the 10-cell carton and weighed about the same. Prices paid by consumers varied in different areas and from week to week.

Regardless of the area from which questionnaire cards were received, similar reasons were given by respondents for liking or disliking the prepackaged peaches.

Typical Comments from Dissatisfied Customers:

1. Peaches too hard and green
2. Peaches bruised by contact with package
3. Too ripe, we lost five out of package
4. Three out of 10 were damaged
5. Not enough visibility
6. Cannot see decay on underside
7. Took too long to remove fruit
8. They do not keep well
9. No taste--peculiar odor
10. Too expensive

Typical Comments from Satisfied Customers:

1. Peaches were juicy, flavorful, delicious
2. No bruises or marks, thus we ate all we paid for
3. Perfect condition--large and rosy--uniform in size
4. Not as many soft spots as bulk peaches
5. Far superior to any peaches I ever bought--previous package same
6. Exactly the way we like peaches--firm, but not too green
7. Attractively packaged
8. Because of special container I felt I was getting top grade "A" selected fruit
9. Visibility--no cellophane--could be tested by smell also
10. They were easy to store
11. Convenience--don't crush or bruise in refrigerator as when loose

Replies Spur Quality Control

The primary reason for inserting the cards in the consumer cartons was to obtain all the information possible about the condition of the peaches and the container at time of purchase, and to relay this information to the packers and shippers as soon as possible. It was hoped this would encourage them to improve their packaging methods and procedures and to get a higher quality peach to the consumer.

U. S. Department of Agriculture representatives observing methods of packing noted early in the season in several plants that peaches were sometimes slightly too green or too soft to be packed properly in the cell cartons. This lack of quality control undoubtedly accounted for some of the earlier criticisms received on the questionnaire cards; returns during the latter part of the peach season indicated that the growers were packing peaches of higher quality in the cartons than during the first part of the season.

PLANS FOR RESEARCH DURING THE 1959 PEACH SEASON

Peach growers all over the country are becoming increasingly aware of the need for improvements in marketing peaches. They know that consumers prefer high quality firm-ripe peaches to hard-mature fruit, and they know that the consumers will pay premium prices to get riper peaches. Improved packaging is essential to deliver these riper peaches to the consumers.

A good package for peaches must protect the peaches; it must facilitate rapid packing; and it must be accepted by the trade and consumers. Packing the harvested peaches cannot be delayed without losses from overripening.

The USDA plans to continue its cooperation with growers and shippers to develop and evaluate improved packages for peaches. Although this report is concerned with prepackaging peaches, plans for future research include studies on improved shipping containers wherever they seem to offer promise of delivering better peaches to consumers. Assistance from container manufacturers is needed and welcomed in these efforts.

APPENDIX

PRELIMINARY EXPERIMENT IN PREPACKAGING PEACHES IN ARKANSAS, 1958 10/

Objective

Following the research in the Southeast, the USDA was requested to extend its work to Arkansas in the spring of 1958. The primary objective was to evaluate consumer packages and master shipping containers to determine which would be best suited to the area needs in transporting firm-ripe peaches to markets, and to assist in setting up a pilot packaging line.

The work was conducted at a plant of a large growers' association in cooperation with the Departments of Agricultural Economics and Horticulture of the University of Arkansas.

Background

The U. S. No. 1 peaches shipped in bulk were packed in 1 1/9-bushel wirebound crates and U. S. No. 2 peaches were packed in conventional tub-type bushel baskets. No prepackaging had been done by this plant before 1958.

Before the 1958 packing operations began, the old equipment was replaced by modern automatic and semiautomatic machinery. The new machinery included an automatic dumper, aluminum roller-type grading tables, a brushing machine, a rapid sizer, and four automatic bulk fillers.

The 1958 peach marketing season began about June 15 and lasted until about August 10. Most of the peaches, both prepackaged and bulk, were shipped and sold in the North Central States to chainstores. Thirteen varieties of peaches were packed, ranging from the early Cardinal to the Elberta and Red Skin, the last varieties harvested.

Packages and Master Container Studied

Five types of consumer packages were studied. Three were selected on the basis of previous performance in carrying soft fruits to market: one had

10/ Donald E. Farris, Department of Agricultural Economics and Ahmed A. Katton, Department of Horticulture, University of Arkansas, cooperated in this phase of the study.

been used for peaches, one for grapes and pears, and one for tomatoes. Two were new and untried (fig. 8).

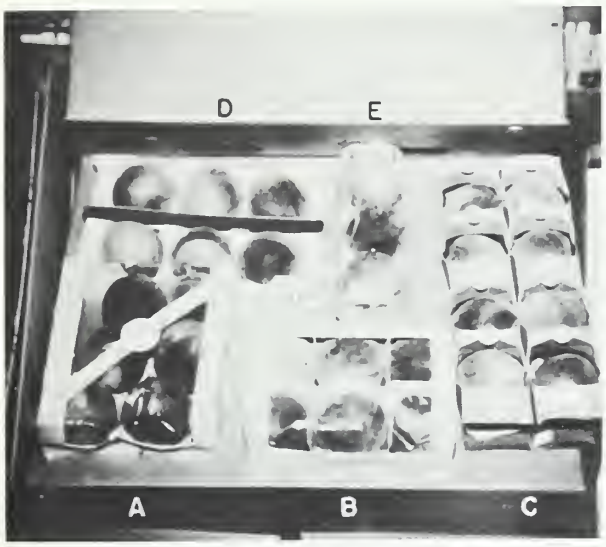

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Figure 8.--These five consumer packages were evaluated in the Arkansas study. "A" was an acetate window carton with stapled-in recessed bottom; "B" was an acetate window carton with folding self-locking cover; "C" was an 8-cell carton; "D" was a folding tray with six cells; and "E" a plastic tray.

After the consumer packages were selected and samples made available, local manufacturers of fiberboard and wirebound boxes were invited to help develop master containers.

A description of the various consumer packages and master containers follows:

1. The acetate-window carton with a stapled-in recessed bottom was assembled by manually folding out sides from the top to form a box. Six peaches were placed in the carton as it lay upside down. The bottom, a piece of corrugated fiberboard, was placed on top of the packed peaches and was stapled in place by a caddy stitcher. The carton was then turned right side up and packed into the master container.

The six peaches were approximately 2 3/4 inches in diameter, and when packed, the carton weighed about 2 pounds. Its dimensions were 7 1/4 by 6 3/4 by 3 inches. A section of the cardboard covering the acetate window was perforated for easy removal in the retail store to display the peaches in the package.

The master container for this package was a corrugated fiberboard box with a full telescope cover. It held 12 consumer packages, 6 in each layer. Both the top cover and bottom case were assembled by a semiautomatic stapling machine.

2. The acetate-window carton with folding self-locking cover was assembled by manually folding out sides, pushing bottom into place, and folding down compartmental dividers. When assembled, this carton, of waxed chipboard, had a cell for each peach. Six peaches, approximately 2 1/2 inches in diameter, were packed in the carton, which was closed by a cover self-locking on the side. A perforated section of the top protecting the acetate window could be removed in the retail store for visibility. The carton had dimensions of 7 1/2 by 5 by 2 1/2 inches and weighed about 2 pounds when properly packed.

The master container used to ship these cartons was a corrugated fiberboard box with a full telescope top. This container was rectangular with a sheet of corrugated fiberboard between the layers of packages. At each end of the fiberboard container there were perforated holes, which not only acted as handholes, but as air vents as well. Twelve consumer packages were packed in this master container, six in each layer.

3. The eight-cell cartons with wirebound master containers were the same as those already discussed earlier in this report.

4. The plastic tray commonly used for prepackaged tomatoes, held 3 peaches approximately 2 3/4 inches in diameter and weighing about 1 pound. The tray was 8 by 2 1/2 by 2 inches. After the tray was packed, it was placed in a perforated polyethylene bag and sealed with either a staple or heat-sealer, or both. The bag was about 12 1/2 by 6 inches.

The master container used to ship this package was the same one discussed under consumer package No. 2; it held 20 plastic trays, 10 in each layer.

5. The folding tray with 6 cells was assembled manually by folding. Six peaches, approximately 2 3/4 inches in diameter, were packed in the cells. After being packed, the tray was overwrapped in cellophane or polyethylene and closed by heat-sealing. The weight when packed was about 2 pounds. Dimensions were 9 3/4 by 5 3/4 by 2 3/4 inches.

The master container used for this package was a wirebound box. It held 12 trays in 3 layers with a sheet of chipboard between the layers. The wirebound box was assembled manually with a handtool.

6. The bulk container used for shipping U. S. No. 1 peaches to market was a 1 1/9-bushel wirebound crate with special built-in cushioning of single-faced corrugated paper attached on four sides and bottom. After hydrocooling, a paper pad was placed over the peaches before the cover was secured.

Packing Experimental Consumer Packages

An experimental prepackaging line was designed, set up, and tied in with the main operations. Workers were transferred from the bulk packing line and trained in their new tasks. Time studies on packing the five consumer units were not obtained because the entire operation was on a small experimental scale.

In most peach plants, new prepackaging operations are undertaken initially on a manual basis. Two of the consumer packages observed in the Arkansas experiment appeared better suited than the other three for a hand operation on

a commercial scale--the 8-cell carton and the acetate-window carton with self-locking cover. If packed in any considerable volume, the other three units would require the use of mechanized equipment.

All of the packages are adaptable to mechanization. However, no comparative studies have been made indicating which consumer package would be best in a mechanized operation.

Condition of Peaches on Arrival at Terminal Market and at Retail Stores

Although a number of lots of peaches were experimentally packaged in each type of consumer unit and shipped during the season, only one controlled test shipment was made in which all five consumer packages were packed and shipped under comparable conditions. Ten controlled shipments had been planned. However, the preliminary tests, plus the one controlled shipment, indicated that 4 of the 5 packages needed further improvements--such as changes in size, design, and printing--to make them satisfactory from the retailers' point of view.

The controlled test shipment of prepackaged and bulk peaches was shipped from Arkansas July 23 and was inspected at both terminal warehouse and retail stores in Detroit on July 25 and 26. There were 10 master containers of each type of consumer package in the shipment with the balance of the load in bulk containers.

Both bulk and prepackaged peaches arrived at the terminal warehouse in good order. The less mature bulk peaches showed less slight bruising and damage by bruising, but more serious bruising--2.0 percent--than any of the prepackaged peaches (table 9). No serious bruising was found in three types of the consumer packages. In the folding cell tray, serious bruising was 0.5 percent and in the cell carton it was 1.6 percent.

In the retail stores the bulk peaches showed more bruising than the prepackaged peaches. In all the prepackaged units, there was fractionally less slight bruising and more severe bruising in the retail stores than at the warehouse level. Bruising of bulk peaches was much higher in all degrees of bruising at the retail stores than it had been at the terminal warehouse.

There was no indication from the test shipment that any one package was superior to another in providing protection for firm-ripe peaches.

Table 9.--Bruising of peaches, shipped from Arkansas in five types of consumer packages and in bulk containers, on arrival at receiving warehouse and at retail stores, Detroit, July 1958 1/

Container	Warehouse			Retail stores		
	Slight 2/	Damage 3/	Serious 4/	Slight 2/	Damage 3/	Serious 4/
	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.
1. Acetate-window carton with recessed stapled bottom	4.0	1.7	0	3.3	2.7	0.5
2. Acetate-window carton with self-locking cover on side	3.8	2.2	0	3.3	3.3	0.5
3. Cell carton	6.2	2.0	1.6	5.8	5.8	2.0
4. Plastic tray with overwrap	5.5	0.5	0	2.7	1.1	0.5
5. Folding cell tray	5.5	2.7	0.5	4.4	2.7	0.5
6. Bulk 1 1/9-bushel crate	0.6	0	2.0	7.0	5.0	8.0

1/ Test shipment consisted of 10 containers of each type of consumer package and 184 bulk containers.
2/ Slight bruising.
3/ Damage by bruising.
4/ Serious bruising.

Trade Reaction to Peaches in Experimental Packages

Each of five retail stores received two master containers of each consumer package being tested. Managers of these stores and the area produce merchandiser agreed that the acetate-window carton with recessed bottom was the best. The other packages did not sell as well. The preferred package was attractively printed, whereas the others were not--being samples from manufacturers' stocks.

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—508927